TO
Cut the Rigging:
AND
PROPOSALS
For the
IMPROVEMENT
OF
Great Artillery.

By *ROBERT ANDERSON.*

LONDON:
Printed for *Robert Morden*, at the *Atlas* in *Cornhill*, 1691.

TO

Cut the Rigging:

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for an

IMPROVEMENT

OF

Great Britain.

By ROBERT ANDERSON

LONDON:

Printed for Robert Morden, at the Blue Ball in
Cornhill, 1697.

To all Ingenious Perſons that are imployed in, and love the Uſe of *Great Artillery.*

HOW the French *Engineers and Gunners come to be ſo skilful, to do ſuch Service with their* Great Artillery *by Sea and Land, may be ſeen at* Prop. *IV. hereof.*

Our Engliſh *Engineers and Gunners may learn to be more skilful with their Artillery (at Sea, at* Prop. *I. hereof; and by Land, in a Treatiſe* To Hit a Mark, *lately publiſh'd) than the* French.

If our Engliſh *Engineers ſay, That it is ſo much of Art that they cannot uſe it, the Anſwer is, Then they muſt be foyl'd by them that will learn Art and uſe it. If they ſay they can do it without Art, 'tis true; but that will require much more Time and Charge before they can come near the Mark,* And becauſe ſome do not know Art, therefore others muſt not practiſe Art. *Not to ſay what might be ſaid, but to bring Art into Practice: I freely offer, if it might pleaſe thoſe* Generous *and* Noble Souls *whom it concerns, to command the Gunners, and the Gunners to be ſo kind to themſelves and the Country that they ſerve, as to go with me to* Wimbleton-Heath, *where I have Guns mounted, fit for extraordinary Service, and have practiſed my ſelf near* 20 *Years; there will I endeavour to teach them the Uſe of the Mortar and Long Gun, according to Art, which is much better than that abſurd way which they now uſe.*

One thing I have for a long time wondered at, viz. *That the Train of Artillery under all its Circumſtances, being ſo very chargeable, and its Execution of ſo great importance, and yet the Practice thereof neglected in the greateſt Extream.*

I hope no Man will count those things difficult, or too much of Art, which falls so necessary in his Way, to serve his King and Country. All ingenious Persons know, that Art at first seems difficult, yet with some Study and Practice becomes very easie.

For when that great Mathematician Torricellius *came to strike a Mark upon Ascents and Descents in the Parabola, he found it so difficult, that he himself confesses, That he had no Science to resolve it.* De Motu Project. pag. 220. *But being now resolved, is become wonderful easie to them that will consider it.*

Certainly, it may be taken for a General Rule, The more any Person is Mathematical, or knowing in the Mathematicks, the fitter he is for all the parts of Military Affairs; and likewise a Nation never receives greater Damage and Disgrace, than when ignorant and unfaithful Persons are put in Places of Trust, which I wish never to see in England

Whilst I am

Jan. 14. 16[illegible]

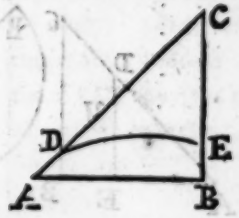
ROB. ANDERSON.

To Cut the Rigging.

LET A be one Ship, and B the other, and BC the Rigging to be Cut in the Point E.

Proposition I.

The greateſt Range of the Piece in the Parabola, the Line of Impulſe, the Aſcent, or Height of the Rigging to be Cut, and the Angle of Elevation being given. To find the Horizontal Diſtance, or the Diſtance from one Ship to the other.



Then, In the Right Angled Triangle ABC, the Angle BAC, the double of the greateſt Range in the Parabola G, of the Culverin; the Line of Impulſe AD, and the Perpendicular Aſcent BE, or the Height of the Rigging to be cut with this Qualification, as G:DC :: DC : CE being given. To find AB the Diſtance of the two Ships.

Then $R : r+Z :: S : BC$, that is $\frac{rS+ZS}{R} = BC$ in Diag. and $\frac{Z^2}{G} = CE$ in Diag. then $\frac{Z^2+PG}{G} = BC$ in Diag. that is $\frac{Z^2+PG}{G} = \frac{ZS+rS}{R}$ that is $Z^2R = ZGS + GrS - GPR$.

G =	9374	the double of the greateſt Range of the
BE = P =	5	Paces, 5 foot to a Pace. (Culverin.
AD = r =	106	
Sine of 8d = S =	13917	
Rad. = R =	100000	
DC = Z =	1371.31	

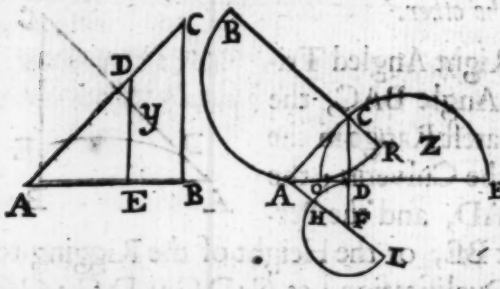
The Equation in Numb. $Z^2 = Z1304.57958 + 91415.43548$

A Method to extract the Roots of ſquare Equations.

Take half the Number of the Coeficient. To the ſquare of that half, add or ſubtract the abſolute Number, according to the Sign + or −, then extract the ſquare Root of that Sum or Difference, which Root added to or ſubtracted from the half Coeficient, the Sum or Difference will be the Root of the Equation.

Example. Half the Coeficient is 652.28979, its ſquare is 425481.9701382441, to which add the abſolute Number 91415.43548, the Sum is 516897.4056182441, whoſe ſquare Root is 718.95, which added to the half Coeficient makes 1371.24 the deſired = Z.

Geometrically thus,



In *Fig.* Z, If OD be made the Aſcent, and DE the double of the greateſt Range in the Parabola, DC will be a mean Proportion. In *Fig.* Y, If AC be made Radius, and CB the Sine of the Angle of Elevation, and AD the Line of Impulſe, then DE will be a fourth Proportion. In *Fig.* Z, If RC be made equal to DE in *Fig.* Y, and CD in *Fig.* Z, be made equal to the double of the greateſt Range, then CA will be a mean Proportion. Further in *Fig.* Y, if AC be Radius, and CB the Sine of the Angle of Elevation, and AD be made equal to the greateſt Range in the Parabola, then DE will be a fourth Proportion. Let DF in *Fig.* Z, be made equal to DE in *Fig.* Y, then AL will be the Line deſired.

GP = ſquare of DC, and $\frac{GrS}{R}$ = ſquare of AC, alſo becauſe the ſine of GP is −, and $\frac{GrS}{R}$ is +, therefore the ſquare of AD is the difference of thoſe Squares, 47. I. *Euclid.* and $\frac{GS}{2R}$ = the Line DF, therefore the Square of DE + the ſquare of AD is = the ſquare of AF, which Line AF + DF = AL the Line deſired.

By Logarithms.

G	9374	3.971925
r	106	2.025306
8 deg.	8.13917	4.143555
Sum Log.		10.140786
R	100000 sub.	5.000000
	½	5.140786
CA	371.87 is	2.570393

G	9374	3.971925
8 deg.	S	4.143555
GS		8.115480
2R	subst.	5.801030
DF	652.31	2.814450

G	9374	3.971925
P	5	0.698970
GP		4.670895
DC		2.335447
CA	subst.	2.570393
Sine of DAC		9.765054
tang. of DCA		10.143085
DC		2.335447
AD from		12.480532
DF	subst.	2.814450 from
tang. of AFD		9.666082
fine of FAD		9.957736 sub.
AF	719.	2.856714
FD	652.31	
AL	1371.31	

r = 106

Z = 1371.24

$r+Z$ = AC 1477.24 3.169468

Sine 82. 9.995753

AB 1462.9 3.165221

A	B
Deg.	*Hor. Diſt.*
3	606.01
4	790.66
5	965.35
6	1134.6
7	1300.2
8	1462.9

In the Column A the Deg. of Elevation, to hit an Object at the Horizontal Diſtances in the Column B, at the Aſcent of 5 Paces with a Culverin.

Two Ships lying at the diſtance of 1135 Paces, the Culverin requires 6 deg. of Elevation, charged with 10 Pound of Powder, to hit the other Ship at 5 Paces above the plain Parallel to the Horizon where the Gun is mounted.

Here note, The Diſtance between the two Ships is to be taken by Inſtrument, or by good Eſtimation.

Of a MUSQUET. Prop. II.

A Muſquet-Barrel made a little wider towards the Britch than forward, the Britch-pin eaſily to ſcrew in and out, to take aim at the Mark by the inſide of the Piece, fixed faſt with Timber and Screws, with a Ball fitting the Muzzle of the Piece, charged with half an Ounce of Powder, put to a Mark, Ranged the Ball in a right Line 200 Yards, or 120 Paces (wonderful exactly) if not farther. *Wimbleton-Heath* in the Year 1690.

By this we find the greateſt Range of the Muſquet thus,

The Line of Impulſe of the Saker	124	2.093422
The greateſt Range of the Saker	5654	3.752356
The Line of Impulſe of the Muſquet	120	2.079181
The great. Range of the Muſq. *proxime*	5472	3.738115

that is, more than 5 Engliſh Miles.

By this, and what is ſaid at *Prop.* VIII. *To Hit a Mark*, the *Futura* of a Muſquet is known.

There are Fowling-Pieces whoſe Length of their Chaſes are 8 Foot, the Diameter of their Bores Baſtard-Muſquet, that is $\frac{7}{10}$ of an Inch; ſuch a Piece (certainly) will Range its Ball 10 Miles (the Air excepted). What Uſe may be made of this, I leave to ingenious Perſons that delight in theſe Matters.

Here ſome cry aloud againſt theſe great Ranges, but what my Hands act, and my Feet meaſure, and my Eyes ſee, I ſhall freely aſſert, and endeavour to maintain.

Of

Of GRANADOES *commonly call'd blind.* PROP. III.

SUch are those Granadoes which have no Fuse burning in the flight, but has a Steel and Flint or Firestone placed within the Granado, to fire the Powder when it arrives to the Earth; the Description of which is set down in *Casimire* in his great Art of Artillery, *Part* I. *Book* IV. *Chap.* 3. in Plate marked M, *Fig.* K, Numb. 121; as also the Cylindrical Firestiot, the Spheriode with a Dovetail to be screwed in, to direct it in its flight, Boxes to be fill'd with small Granadoes and other things of consequence, to be shot either out of the Mortar-piece or Long-Gun, are treated on in the fore-cited place, and therefore saves the labour here.

These, with many other things belonging to great Artillery lie fair from Improvement.

PROP. IV.

IN the Year 1673. I published my *Genuine Use of the Gun*, upon the Principles of *Galileus* without any accidental Impediment, that is, that the Transit of the Bullet to be in the Curve of a Parabola, and from that to Hit a Mark at demand within the reach of the Piece Analitically, as well upon Ascents as Descents, as upon the Plain of the Horizon. In the Year 75, Monsr. *Blondell* in his *de jeter les Bombes*, *pag.* 283. propounded that Problem to the Royal Academy of Sciences of *France*, to be resolved Geometrically, Monsr. *Buot*, *Romer* the Sweed, and Monsr. *de la Hire* set upon the Mathematical Part, from Page 285. to Page 312. of the said *de jeter les Bombes*; whilst Monsr. *Marriott* and *Perault* made many Experiments several times repeated before the Royal Academy, Monsr. the *Dauphin* being present,

viz.

viz. with Water, with a Bow, with a Cross-Bow, a Stone-Bow, an Engin in imitation of the ancient Baliſtes, with a Piſtol, and with Quickſilver, all agreeing preciſely with that of *Galileus de jeter les Bombes, pag.* 490. For which Service the *French* King made Monſ. *Blondell* Maſter de Camp and gave him about 200*l.* ſterl. a Year, as I am credibly informed. Whilſt the *French* Mathematicians and Philoſophers were a trying the Truth of this noble Invention of the famous *Galileus*, for the carrying on of their Warlike Deſigns; here in *England* ſome Perſons made Experiments upon *Black-Heath*, and near *Newington-Butts*, but what they amounted to I know not.

By theſe means the *French* Engineers ſling their Shot as exactly as the *Benjamites*, and ours in *England* remain as at firſt.

But as I have been at ſome Pains and Charge to bring the Uſe of Great Artillery to a greater perfection than formerly, in my *Genuine Uſe of the Gun*, and in a Treatiſe *To Hit a Mark*, ſo now, I move forward, that ingenious Perſons may be inſtructed in that Art, ſo they may be capable to ſerve, and to be an Honour to their King and Country.

In order to which:

For the Improvement and Practice of the MORTAR.

LET there be a firm Platform, and a Mortar-piece about 6 Inches diameter, with a fit Ball, mounted in a Carriage to move from an Horizontal to a Vertical Line, and to be firmly fixt to any degree and Minute at demand, and even ground for two Mile in length; ſuch a Platform, Mortar-piece, and level Ground, is fit for extraordinary Service, and to inſtruct the Gunners, that ſo they may ſee

and

and understand the Ranges of their Piece, and learn to strike any Mark at demand within the reach of the said Piece.

The Gunners to be instructed one day in a Week throughout the Year, and upon publick days to shoot for a Piece of Plate given by the King, tho to the value of 5 *s.* in doing which, His Majesty will be no Loser if Wars continue.

For the Improvement and Practice of LONG-GUNS.

LET there be a firm Platform to mount the Guns upon, and 2 or 3 Mile of Ground to Range the Shot, and a moveable Butt to be set up perpendicular to the Horizon, the Gunners to be practised one day in a Week, and to shoot for a Piece of Plate on general days; such a Method will make them expert Gunners, and that Prince that will not use some such Method to exercise his Gunners, will lose a great deal more than that Charge comes to when he puts them to Service.

If any make Objections, and say, That the Gunners cannot practice that of the Parabola.

To which I Answer.

I'll take a Gunner of the Capacity of a Youth of 14 years of Age, and teach him Arithmetick, and so much of Geometry that is requisite for Practice, and learn him the Use of the Mortar, that he shall be capable to strike any Mark at demand within the reach of the Piece when it is demanded of him, and to teach the rest of the Gunners to do the like.

But,

If the Gunners say they can strike any Mark at demand within the reach of the Piece according to that of the Parab.

Then,

Then, To conclude my Endeavours.

Concerning the Improvement of *Great Artillery*, I freely offer to be at the Charge of Platform, Mortar-piece mounted, Powder, Ball, and all things necessary for extraordinary Service, and a Medal of Silver, if they whom it chiefly concerns will command the Gunners to endeavour to strike a Mark at any place within the reach of the Piece, and he that comes neareſt the Mark with the moſt rational Rules of Art, ſhall have the Medal of Silver.

Not to omit the Example of two eminent Soldiers.

When the Lord *Fairfax* beſieged *Worceſter*, he had a *Scotch* Man for his Engineer; *Nathaniel Nye*, a very young Man, went to the L. *Fairfax*, and deſired that he and the *Scotch Engineer* might have a fair Tryal with their Mortar-piece againſt the Town, and he that did the beſt Service, ſhould be the L. *Fairfax*'s Engineer; to which the L. *Fairfax* readily anſwered, All the reaſon in the world. The ſaid *Nat. Nye* blew up the Magazine, which forced them to ſurrender, for which he was made the L. *Fairfax*'s Engineer, and Maſter Gunner of *Worceſter*. From an eminent Perſon now living that was an Eye and Ear Witneſs.

Oliver Cromwell ſent for Mr. *Wright*, a Joyner by Profeſſion, and took care of his Family, ſent him to the Siege of *Dunkirk*, with 2 Eighteen Inch Mortar-pieces, which were ſo well managed by the ſaid *Wright* and one *Stint*, that the firſt Granado they threw into the Town fell near the Town-Houſe, and made ſuch a prodigious Breach, that the Governur of the Town ſet up the white Flag immediately, and capitulated.

But when unworthy Perſons and Relations were preferr'd the Government dwindled to

FINIS.